

Application Serial No.: 09/883,007

Attorney Docket No.: Reveo-0127

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Jiang, et al.

SERIAL NO.: 09/883,007

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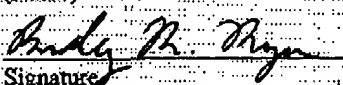
TITLE: Cholesteric Liquid Crystal Polarizing
Device

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Commissioner for Patents
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Sir:

Prior to examination on the merits, please consider this application in light of the following remarks. No new matter has been introduced.

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REMARKS

Claims 1-5 and 7-13 are rejected under 35 U.S.C. Section 103(a) as being unpatentable over U.S. Patent No. 5,731,859 to Kulkarni ("Kulkarni") in view of U.S. Patent No. 6,556,262 to Stephenson et al. ("Stephenson"). Claims 6 and 14 are rejected under 35 U.S.C. Section 103(a) as being unpatentable over Kulkarni in view of Stephenson and further in view of U.S. Patent 5,796,454 to Ma ("Ma").

Claims 15-18 and 25-27 are rejected under 35 U.S.C. Section 103(a) as being unpatentable over U.S. Patent to Willet et al. ("Willet") in view of Kulkarni and Stephenson. Claims 19-23 and 29 are rejected under 35 U.S.C. Section 103(a) as being unpatentable over Willet in view of Kulkarni and Stephenson and further in view of Ma. Claim 24 is rejected under 35 U.S.C. Section 103(a) as being unpatentable over Willet in view of Kulkarni and Stephenson and further in view of U.S. Patent 5,796,447 to Okumura et al. ("Okumura").

Claims 30, 31, and 33 are rejected under 35 U.S.C. Section 103(a) as being unpatentable over Willet in view of Kulkarni and Stephenson and Ma. Claim 32 is rejected under 35 U.S.C. Section 103(a) as being unpatentable over Willet in view of Kulkarni and Stephenson and Ma and further in view of Okumura. Claims 34-37 are rejected under 35 U.S.C. Section 103(a) as being unpatentable over Willet in view of Kulkarni and Stephenson/Ma and further in view of U.S. Patent 5,737,044 to Van Haaren et al. ("Van Haaren").

Claims 1-37 are pending.

Rejection of Claims 1-5 and 7-13 under 35 U.S.C. Section 103(a)

The Office Action states that Kulkarni discloses in Figs. 2 and 3 a cholesteric liquid crystal polarizing device comprising: a substrate or glass, an alignment layer or polyimide, and a

cholesteric liquid crystal layer including multiple domains skewed at distribution angles and including a plurality of sub-domains, said sub-domains being disposed within a distribution of angles relative to said at least one domain, each of said domains skewed at an angle relative to a plane parallel to said substrate or skewed at a substantially uniform angle, but does not disclose domains being skewed at random angles.

Kulkarni does not teach or suggest the invention recited in claim 1. Specifically, Kulkarni does not teach a cholesteric liquid crystal polarizing device that includes a substrate, an alignment layer, and a cholesteric liquid crystal layer including multiple domains where each of the domains is skewed at a random angle relative to a plane parallel to the substrate.

The Office Action further states that Stephenson discloses, in fig. 3B, a cholesteric liquid crystal display device including domains skewed at random angles.

Applicants respectfully disagree with the characterization and interpretation of Stephenson. Because this reference does not, in fact, describe what is alleged in the Office Action, applicants submit that the combination of these references is improper and that the section 103(a) rejections are incorrect.

Stephenson describes a coatable light-modulating sheet. The sheet includes a substrate, an electrically conductive layer, and a light modulating layer. The light modulating layer can contain a cholesteric liquid crystal, which can be a chiral doped nematic liquid crystal. Fields of various intensities and duration can be applied to change the state of the chiral doped nematic materials from a reflective to a transmissive state. The materials can maintain a given state indefinitely after the field is removed (See Col. 3, Line 15-44). Figs. 3A and 3B show two stable states of cholesteric liquid crystals. In Fig. 3A, a high voltage field has been applied and quickly switched to zero potential, which causes cholesteric liquid crystal molecules to go into a planar state. In Fig. 3B,

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application of a lower voltage field has caused molecules of the cholesteric liquid crystal to break into transparent tilted cells known as the focal-conic state (See Col 4, lines 24-30). Nowhere in Stephenson are random domains taught or suggested. In fact, the word random is never used at all.

Stephenson does not teach or suggest the invention recited in claim 1. Specifically, Stephenson does not teach a cholesteric liquid crystal polarizing device that includes a substrate, an alignment layer, and a cholesteric liquid crystal layer including multiple domains where each of the domains is skewed at a random angle relative to a plane parallel to the substrate.

In view of the foregoing, it is respectfully submitted that Kulkarni and Stephenson, whether taken alone or in combination, do not teach or suggest the subject matter recited in claim 1, as each of these references fails at least to teach or suggest a cholesteric liquid crystal polarizing device that includes a substrate, an alignment layer, and a cholesteric liquid crystal layer including multiple domains where each of the domains is skewed at a random angle relative to a plane parallel to the substrate.

Claims 2-5 and 7-13, which depend directly or indirectly from the independent claim 1 incorporate all of the limitations of claim 1 and are therefore also patentable over Kulkarni and Stephenson for at least those reasons provided for claim 1.

Rejection of Claims 6 and 14 under 35 U.S.C. Section 103(a)

The Office Action states that the combination of Kulkarni and Stephenson discloses the device structure as recited in the claim, but does not specifically disclose pixel regions. The Office action further states that Ma discloses a cholesteric LCD comprising a monochromatic device wherein pixel regions are arranged in a repeating array of red pixels, green pixels, and blue pixels,

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said red pixels reflecting circularly polarized red light, said green pixels reflecting circularly polarized green light, and blue pixels reflecting circularly polarized blue light.

However, as previously detailed above, Kulkarni and Stephenson, whether taken alone or in combination, do not teach or suggest the subject matter recited in claim 1, as each of these references fails at least to teach or suggest a cholesteric liquid crystal polarizing device that includes a substrate, an alignment layer, and a cholesteric liquid crystal layer including multiple domains where each of the domains is skewed at a random angle relative to a plane parallel to the substrate. Claims 6 and 14, which depend directly or indirectly from the independent claim 1 incorporate all of the limitations of claim 1.

In view of the foregoing, it is respectfully submitted that Kulkarni, Stephenson, and Ma, whether taken alone or in combination, do not teach or suggest the subject matter recited in claims 6 and 14, which depend directly or indirectly from the independent claim 1 and incorporate all of the limitations of claim 1, and are therefore also patentable over Kulkarni, Stephenson, and Ma for at least those reasons provided for claim 1.

Rejection of Claims 15-18 and 25-27 under 35 U.S.C. Section 103(a)

The Office Action states that Willet discloses, in fig. 2, a reflective liquid crystal display comprising a planar cholesteric liquid crystal polarizing device, a liquid crystal cell, and an internal quarter-wave retarder, said cholesteric liquid crystal polarizing device, said liquid crystal cell, and said quarter-wave retarder being superposed with one another, but omits a cholesteric liquid crystal polarizing device, including multiple domains, each of said domains skewed at a substantially uniform angle or at a random angle relative to a plane parallel to the cholesteric LCD.

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The Office Action further states that Kulkarni discloses, in figs. 2 and 3, a cholesteric liquid crystal polarizing device including multiple domains skewed at a substantially uniform angle or skewed at distribution angles and including a plurality of sub-domains, said sub-domains being disposed within a distribution of angles relative to said at least one domain, each of said domains skewed at an angle relative to a plane parallel to the cholesteric LCD.

Neither Willet nor Kulkarni teach or suggest the invention recited in claim 15. Specifically, Willet and Kulkarni do not teach a reflective liquid crystal polarizing display which includes a liquid crystal cell, an internal quarter-wave retarder, and a planar cholesteric liquid crystal polarizing device, which includes multiple domains where each of the domains is skewed at a random angle relative to a plane parallel to the cholesteric liquid crystal polarizing device; and where the cholesteric liquid crystal polarizing device, the liquid crystal cell, and the quarter-wave retarder are superposed with one another.

The Office Action still further states that Stephenson discloses, in fig. 3B, a cholesteric liquid crystal display device including domains skewed at random angles.

As stated above, Applicants respectfully disagree with the characterization and interpretation of Stephenson. Because this reference does not, in fact, describe what is alleged in the Office Action, applicants submit that the combination of these references is improper and that the section 103(a) rejections are incorrect.

As previously discussed, Stephenson describes a coatable light-modulating sheet. The sheet includes a substrate, an electrically conductive layer, and a light modulating layer. The light modulating layer can contain a cholesteric liquid crystal, which can be a chiral doped nematic liquid crystal. Fields of various intensities and duration can be applied to the change the state of the chiral doped nematic materials from a reflective to a transmissive state. The materials can maintain a

given state indefinitely after the field is removed (See Col. 3, Line 15-44). Figs. 3A and 3B show two stable states of cholesteric liquid crystals. In Fig. 3A, a high voltage field has been applied and quickly switched to zero potential, which causes cholesteric liquid crystal molecules to go into a planar state. In Fig. 3B, application of a lower voltage field has caused molecules of the cholesteric liquid crystal to break into transparent tilted cells known as the focal-conic state (See Col 4, lines 24-30). Nowhere in Stephenson are random domains taught or suggested. In fact, the word random is never used at all.

Stephenson does not teach or suggest the invention recited in claim 15. Specifically, Stephenson does not teach a reflective liquid crystal polarizing display which includes a liquid crystal cell, an internal quarter-wave retarder, and a planar cholesteric liquid crystal polarizing device, which includes multiple domains where each of the domains is skewed at a random angle relative to a plane parallel to the cholesteric liquid crystal polarizing device; and where the cholesteric liquid crystal polarizing device, the liquid crystal cell, and the quarter-wave retarder are superposed with one another.

In view of the foregoing, it is respectfully submitted that Willet, Kulkarni, and Stephenson, whether taken alone or in combination, do not teach or suggest the subject matter recited in claim 15, as each of these references fails at least to teach or suggest a reflective liquid crystal polarizing display which includes a liquid crystal cell, an internal quarter-wave retarder, and a planar cholesteric liquid crystal polarizing device, which includes multiple domains where each of the domains is skewed at a random angle relative to a plane parallel to the cholesteric liquid crystal polarizing device; and where the cholesteric liquid crystal polarizing device, the liquid crystal cell, and the quarter-wave retarder are superposed with one another.

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Claims 16-18 and 25-27, which depend directly or indirectly from the independent claim 15, incorporate all of the limitations of claim 15 and are therefore also patentable over Willet, Kulkarni, and Stephenson for at least those reasons provided for claim 15.

Rejection of Claims 19-23, 28, and 29 under 35 U.S.C. Section 103(a)

The Office Action states that the combination of Willet, Kulkarni, and Stephenson discloses the device structure as recited in the claim, but does not specifically disclose pixel regions. The Office action further states that Ma discloses a cholesteric LCD comprising a monochromatic device wherein pixel regions are arranged in a repeating array of red pixels, green pixels, and blue pixels, said red pixels reflecting circularly polarized red light, said green pixels reflecting circularly polarized green light, and blue pixels reflecting circularly polarized blue light.

However, as previously detailed above, Willet, Kulkarni, and Stephenson, whether taken alone or in combination, do not teach or suggest the subject matter recited in claim 15, as each of these references fails at least to teach or suggest a reflective liquid crystal polarizing display which includes a liquid crystal cell, an internal quarter-wave retarder, and a planar cholesteric liquid crystal polarizing device which includes multiple domains where each of the domains is skewed at a random angle relative to a plane parallel to the cholesteric liquid crystal polarizing device; and where the cholesteric liquid crystal polarizing device, the liquid crystal cell, and the quarter-wave retarder are superposed with one another. Claims 19-23, 28 and 29, which depend directly or indirectly from the independent claim 15, incorporate all of the limitations of claim 15.

In view of the foregoing, it is respectfully submitted that Willet, Kulkarni, Stephenson, and Ma, whether taken alone or in combination, do not teach or suggest the subject matter recited in claims 19-23, 28 and 29, which depend directly or indirectly from the independent claim 15 and

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incorporate all of the limitations of claim 15, and are therefore also patentable over Willet, Kulkarni, Stephenson, and Ma for at least those reasons provided for claim 15.

Rejection of Claim 24 under 35 U.S.C. Section 103(a)

The Office Action states that the combination of Willet, Kulkarni, and Stephenson discloses the device structure as recited in the claim, but does not specifically disclose a cholesteric liquid crystal comprising a plurality of pixel regions, which are in registration with a plurality of pixel regions of a TFT array. The Office action further states that Okumura discloses a cholesteric liquid crystal display including a TFT array having a plurality of pixel regions, and said plurality of pixel regions of said TFT array are in registration with said plurality of pixel regions of said cholesteric liquid crystal device.

However, as previously detailed above, Willet, Kulkarni, and Stephenson, whether taken alone or in combination, do not teach or suggest the subject matter recited in claim 15, as each of these references fails at least to teach or suggest a reflective liquid crystal polarizing display which includes a liquid crystal cell, an internal quarter-wave retarder, and a planar cholesteric liquid crystal polarizing device which includes multiple domains where each of the domains is skewed at a random angle relative to a plane parallel to the cholesteric liquid crystal polarizing device; and where the cholesteric liquid crystal polarizing device, the liquid crystal cell, and the quarter-wave retarder are superposed with one another. Claim 24, which depends directly or indirectly from the independent claim 15, incorporates all of the limitations of claim 15.

In view of the foregoing, it is respectfully submitted that Willet, Kulkarni, Stephenson, and Okumura, whether taken alone or in combination, do not teach or suggest the subject matter recited in claim 24, which depends directly or indirectly from the independent claim 15 and incorporates all

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of the limitations of claim 15, and is therefore also patentable over Willet, Kulkarni, Stephenson, and Okumura for at least those reasons provided for claim 15.

Rejection of Claims 30, 31, and 33 under 35 U.S.C. Section 103(a)

The Office Action states that Willet discloses, in fig. 2, a reflective liquid crystal display comprising a planar cholesteric liquid crystal polarizing device, a liquid crystal cell, and an internal quarter-wave retarder, said cholesteric liquid crystal polarizing device, said liquid crystal cell, and said quarter wave retarder being superposed with one another, but omits a cholesteric liquid crystal polarizing device, including multiple domains, each of said domains skewed at a random angle relative to a plane parallel to the cholesteric LCD and an absorbing medium.

The Office Action further states that Kulkarni discloses, in figs. 2 and 3, a cholesteric liquid crystal polarizing device including multiple domains skewed at an angle relative to a plane parallel to the cholesteric LCD.

Neither Willet nor Kulkarni teach or suggest the invention recited in claim 30. Specifically, Willet and Kulkarni do not teach a reflective liquid crystal display comprising a linear polarizer having a polarization direction, a liquid crystal cell, a quarter-wave retarder having a fast axis, an absorbing medium, and a planar cholesteric liquid crystal polarizing device including a plurality of pixel regions and multiple domains each of which are skewed at a random angle relative to a plane parallel to the cholesteric liquid crystal polarizing device.

The Office Action still further states that Stephenson discloses, in figs. 1-5, a cholesteric liquid crystal including domains skewed at random angles and an absorbing medium. The Office Action further states that Ma discloses a cholesteric device comprising a liquid crystal cell comprising a twisted agent and an absorbing medium.

As stated above, Applicants respectfully disagree with the characterization and interpretation of Stephenson. Because this reference does not, in fact, describe what is alleged in the Office Action, applicants submit that the combination of these references is improper and that the section 103(a) rejections are incorrect.

As previously explained, Stephenson describes a coatable light-modulating sheet. The sheet includes a substrate, an electrically conductive layer, and a light modulating layer. The light modulating layer can contain a cholesteric liquid crystal, which can be a chiral doped nematic liquid crystal. Fields of various intensities and duration can be applied to the change the state of the chiral doped nematic materials from a reflective to a transmissive state. The materials can maintain a given state indefinitely after the field is removed (See Col. 3, Line 15-44). Figs. 3A and 3B show two stable states of cholesteric liquid crystals. In Fig. 3A, a high voltage field has been applied and quickly switched to zero potential, which causes cholesteric liquid crystal molecules to go into a planar state. In Fig. 3B, application of a lower voltage field has caused molecules of the cholesteric liquid crystal to break into transparent tilted cells known as the focal-conic state (See Col 4, lines 24-30). Nowhere in Stephenson are random domains taught or suggested. In fact, the word random is never used at all.

Neither Stephenson nor Ma teach or suggest the invention recited in claim 30. Specifically, Stephenson and Ma do not teach a reflective liquid crystal display comprising a linear polarizer having a polarization direction, a liquid crystal cell, a quarter-wave retarder having a fast axis, an absorbing medium, and a planar cholesteric liquid crystal polarizing device including a plurality of pixel regions and multiple domains each of which are skewed at a random angle relative to a plane parallel to the cholesteric liquid crystal polarizing device.

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In view of the foregoing, it is respectfully submitted that Willet, Kulkarni, Stephenson, and Ma, whether taken alone or in combination, do not teach or suggest the subject matter recited in claim 30, as each of these references fails at least to teach or suggest a reflective liquid crystal display comprising a linear polarizer having a polarization direction, a liquid crystal cell, a quarter-wave retarder having a fast axis, an absorbing medium, and a planar cholesteric liquid crystal polarizing device including a plurality of pixel regions and multiple domains each of which are skewed at a random angle relative to a plane parallel to the cholesteric liquid crystal polarizing device.

Claims 31 and 33, which depend directly or indirectly from the independent claim 30, incorporate all of the limitations of claim 30 and are therefore also patentable over Willet, Kulkarni, Stephenson, and Ma for at least those reasons provided for claim 30.

Rejection of Claim 32 under 35 U.S.C. Section 103(a)

The Office Action states that the combination of Willet, Kulkarni, Stephenson, and Ma discloses the device structure as recited in the claim, but does not specifically disclose a cholesteric liquid crystal comprising a plurality of pixel regions, which are in registration with a plurality of pixel regions of a TFT array. The Office action further states that Okumura discloses a cholesteric liquid crystal display including a TFT array having a plurality of pixel regions; and said plurality of pixel regions of said TFT array are in registration with said plurality of pixel regions of said cholesteric liquid crystal device.

As previously detailed above, Willet, Kulkarni, Stephenson, and Ma, whether taken alone or in combination, do not teach or suggest the subject matter recited in claim 30, as each of these references fails at least to teach or suggest a reflective liquid crystal display comprising a linear

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polarizer having a polarization direction, a liquid crystal cell, a quarter-wave retarder having a fast axis, an absorbing medium, and a planar cholesteric liquid crystal polarizing device including a plurality of pixel regions and multiple domains each of which are skewed at a random angle relative to a plane parallel to the cholesteric liquid crystal polarizing device. Claim 32, which depends directly or indirectly from the independent claim 30, incorporates all of the limitations of claim 30.

In view of the foregoing, it is respectfully submitted that Willet, Kulkarni, Stephenson, Ma, and Okumura, whether taken alone or in combination, do not teach or suggest the subject matter recited in claim 32, which depends directly or indirectly from the independent claim 30 and incorporates all of the limitations of claim 30, and is therefore also patentable over Willet, Kulkarni, Stephenson, Ma, and Okumura for at least those reasons provided for claim 30.

Rejection of Claims 34-37 under 35 U.S.C. Section 103(a)

The Office Action states that the combination of Willet, Kulkarni, Stephenson, and Ma discloses a cholesteric LCD device structure as recited in the claim including a black mode device and a white mode device, said cholesteric polarizing device reflecting left-hand or right-hand circularly polarized light, but fails to disclose a retarder oriented at 45 degrees. The Office action further states that Van Haaren discloses a retarder oriented at 45 degrees to a polarization direction.

As previously detailed above, Willet, Kulkarni, Stephenson, and Ma whether taken alone or in combination, do not teach or suggest the subject matter recited in claim 30, as each of these references fails at least to teach or suggest a reflective liquid crystal display comprising a linear polarizer having a polarization direction, a liquid crystal cell, a quarter-wave retarder having a fast axis, an absorbing medium, and a planar cholesteric liquid crystal polarizing device including a plurality of pixel regions and multiple domains each of which are skewed at a random angle relative

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to a plane parallel to the cholesteric liquid crystal polarizing device. Claims 34-37, which depend directly or indirectly from the independent claim 30, incorporate all of the limitations of claim 30.

In view of the foregoing, it is respectfully submitted that Willet, Kulkarni, Stephenson, Ma, and Van Haaren, whether taken alone or in combination, do not teach or suggest the subject matter recited in claims 34-37, which depend directly or indirectly from the independent claim 30 and incorporate all of the limitations of claim 30, and are therefore also patentable over Willet, Kulkarni, Stephenson, Ma, and Van Haaren for at least those reasons provided for claim 30.

Conclusion

In view of the foregoing, applicants respectfully request reconsideration, withdrawal of all rejections, and allowance of all pending claims in due course.

Respectfully submitted,


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